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A NEW SPECIES AND A REVIEW OF THE DEEP-SEA FISH GENUS *ASQUAMICEPS* (SALMONIFORMES: ALEPOCEPHALIDAE)

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ABSTRACT

A new species of *Asquamiceps* with a striking cobalt blue head is described from specimens collected at bathypelagic (ca. 2,000 m) depths in the Atlantic Ocean. The new species is compared to the five nominal species in the genus and a key to *Asquamiceps* is presented. One nominal species, *A. indagatio*, is treated as a junior synonym of *A. velaris*.

The anatomy of *A. caeruleus* suggests a relatively primitive grade within the family. The caudal skeleton, with two to four ural centra, four uroneurals, and the distal edge of the lower hypurals ahead of the distal edge of the upper hypurals, is one of the most primitive known in the family. Most derived characters found, such as no mesocoracoid, two epurals and no pelvic splint, are reductional. Suspected relationships of *Asquamiceps* are with *Einara*, *Conocara*, *Leptoderma*, and *Aulostomomorpha*.

A spectacular blue-headed specimen of *Asquamiceps* was captured in the summer of 1959 by H. Bullis aboard M/V OREGON. The specimen was not described, and additional examples were not collected until G. Krefft began catching specimens with large midwater trawls in 1971. This study began as a description of Bullis's specimen, but with the opportunity to examine all of the type material in the genus as well as Krefft's specimens, a review of the genus was begun.

Parr (1954) also reviewed *Asquamiceps* and provided a key and comments on the five known specimens which he placed in five species and three subgenera. Most species are still quite rare in collections and therefore a detailed revision cannot be made. This paper describes and figures the new species of *Asquamiceps* and compares it with its congeners.

METHODS AND MATERIALS.

Standard taxonomic measurements and counts were made (Hubbs and Lagler, 1958). Vertical fin-ray counts were usually verified by radiographs; all rays were counted. Vertebral counts are of preural centra only; the last centrum counted is that which articulates with the parahypural, even if fused to a ural centrum. Vertebral counts are given as the ranges of precaudal + caudal = total. Gillraker counts are given as the ranges of upper limb + the one in the angle of the arch + lower limb = total.

Materials examined are listed under the accounts of each species. Institutional abbreviations used are USNM—United States National Museum of Natural History, Washington, D.C.; ISH—Institut für Seefischerei, Hamburg, Germany; MOM—Musee Oceanographique Monaco; BMNH—British Museum (Natural History), London, England; SIO—Scripps Institution of Oceanography, La Jolla, California; ZMUC—Zoological Museum of the University of Copenhagen, Denmark; and UBNM—Zoological Museum of the University of Bergen, Norway.

RESULTS

Asquamiceps Zugmayer 1911a

Asquamiceps Zugmayer 1911a (Type species by monotypy: *A. velaris* Zugmayer 1911).
Megalepocephalus Fowler 1934 (Type species by original designation: *A. longmani* Fowler 1934).
Perioceps Parr 1954 (Type species by original designation: *A. pacificus* Parr 1954).

Diagnosis.—Alepocephalids with voluminous opercles, the posterior edge of which is composed of bands of muscle and connective tissue; head length 36.8–48.0% SL; opercles covering base of pectoral fin which is large and fan-like; area anteriad of pectoral base naked; peritoneum unpigmented or very lightly pig-

mented; lower jaw with minute uniserial teeth and ending behind posterior margin of orbit; palatine, vomer, and maxillary without teeth; premaxillary with or without teeth; one supramaxillary; gillrakers usually present on lateral and medial surfaces of first four arches (sometimes few and small on medial surface of first arch) with a flap of skin separating the two sets of rakers; body compressed, covered with imbricate to barely or non-imbricate scales, predorsal midline sometimes naked; lateral line present or absent; head naked, some with reticulated pattern approximating scale pockets; dorsal and anal fins approximately equal and opposite; snout to pelvic fin origin 56.6–64.8% SL; total preural vertebrae 37–44, the number of precaudal about equal to or up to 10 less than the number of caudal vertebrae; A 15–19, D 16–20, P_1 13–19, P_2 5–6 without a splint bone on outer ray, branchiostegal rays 5–7, pyloric caeca 3–11.

Key to the Species of *Asquamiceps*

1a. Upper jaw ends well in advance of posterior margin of orbit; orbit 8.9–12.2% SL 2
1b. Upper jaw reaches about to the vertical through the posterior margin of orbit; orbit 5.3–7.7% SL 3
2a. Three or four pyloric caeca; gill rakers on first arch 4–5 + 1 + 9–12 = 15–18; vertebrae 16–17 + 20–21 = 37; P_2 5; lateral line indistinct; scales on body barely imbricate, predorsal midline above pectorals naked; nasals forming ridge down midline of snout; premaxillaries normal; interorbital width 4.6–6.4% SL ..... *A. velaris*
2b. Eight or nine pyloric caeca; gill rakers on first arch 8 + 1 + 16–17 = 25–26; vertebrae 18–21 + 21–24 = 42; P_2 6; lateral line distinct, with black papillae; scales on body imbricate, predorsal midline scaled; nasals normal; premaxillaries with horizontally-aligned visor; interorbital width 7.8–8.4% SL ..... *A. pacificus*
3a. No lateral line; A 15–17; D 16–18; P_1 14–17; P_2 5; vertebrae 21–22 + 20–22 = 42–43; skin on head a deep cobalt blue ..... *A. caeruleus* new species
3b. Lateral line present; A 19; D 19–20; P_1 18–19; P_2 6; vertebrae 18 + 24–26 = 42–44; skin on head brown to black 4
4a. Head with reticulated color pattern resembling scale pockets; anterior lateral line scales separated by overlapping body scales; branchiostegal rays 5, vertebrae 17 + 27 = 44 ..... *A. longmani*
4b. Head without reticulated color pattern; lateral line scales not interrupted by body scales; branchiostegal rays 6, vertebrae 18 + 24 = 42 ..... *A. hjorti*

Asquamiceps velaris Zugmayer 1911a

Asquamiceps velaris Zugmayer 1911a: 2; Zugmayer 1911b: 10, pl. 1 fig. 4.
Asquamiceps indagatio Parr 1954:5.

Material Examined.—Holotype, MOM, 36°06'N, 09°W, 0–3,660 m, 8 September 1910, *Princesse Alice* station 3039, 160 mm SL; BMNH 1930.1.12.1 (holotype of *A. indagatio*), 33°50'–34°13'S, 16°04'–15°49'E, 0–2,580 m, 14–15 October 1926, Discovery station 101, net N450H, 90.2 mm SL; ISH 1537/71 (2 specimens), 27°14'S, 02°56'E, 0–2,000 m, 1 April 1971, Walther Herwig station 435/71, 159 and 171 mm SL; SIO 56-128, 12°12'–37'N, 166°17'–28'E, 0–1,300 m, 3 May 1956, Redwing Expedition, 127 mm SL; SIO 64-11, 24°45.5'–33.6'N, 113°10.7'–25.2'W, 0–1,900 m, 30 January 1964, Horizon, 97.5 mm SL.

Comments.—The nasals form a fairly sharp raised ridge down the midline of the snout. In the holotype it stops 5.5 mm from the tip of the snout while in the other specimens it continues out closer to the tip of the snout. The scales are irregularly

circular, barely or non-imbricate, and absent along the predorsal midline. The number of gill rakers on the first arch (15–18) and the total number of vertebrae (37) are less than any other species in the genus (23–26 and 42–44, respectively). All four of these characters easily distinguish *A. velaris* from its congeners.

The holotype of *A. indagatio* appeared to be a perfectly good example of *A. velaris* and no differences could be found between the two. The previously reported difference of one in the number of branchiostegal rays (Parr, 1954) is not significant since one specimen (ISH 1537/71, 159 mm) had 5 on the left and 6 on the right.

Meristic variation was as follows: D 16–17, A 16–17, P_1 13–15, P_2 5, branchiostegal rays 5–6, gill rakers on first arch 4–5 + 1 + 9–12 = 15–18, vertebrae 16–17 + 20–21 = 37, pyloric caeca 3–4. Males have lobate testes.

Asquamiceps pacificus Parr 1954

Asquamiceps pacificus Parr 1954:6.

Material Examined.—Holotype ZMUC P1777, 06°48'N, 80°33'W, 0–3,500 m wire out, 16 January 1922, DANA station 1208[IV], 82.3 mm SL; SIO 60-207, 21°33.3'–21'N, 123°02.2'–12.3'W, 0–1,500 m, 19 June, 1960, TETHYS Expedition station 4, 57.7 mm SL; SIO 65-209, 27°06.7'–08.7'N, 115°07.0'–10.6'W, 0–9,000 m wire out, 21 June, 1965, HORIZON, 78.3 mm SL.

Comments.—The holotype is partly damaged, being somewhat flattened laterally and with a damaged sphenotic region. The SIO specimens are in better shape but are smaller yet agree with or are similar to the holotype in all characters examined. The premaxillaries of the SIO specimens clearly have a sharp lateral visor. A premaxillary visor has not been found in any of the other species of *Asquamiceps* but the premaxillary is easily lost or damaged and the usefulness of this character must await additional material.

Meristic variation was as follows: D 17–18, A 16–17, P_1 15–17, P_2 6, branchiostegal rays 6, gill rakers on first arch 8 + 1 + 16–17 = 25–26, vertebrae 18–21 + 21–24 = 42, pyloric caeca 8–9. Testicular structure unknown.

Asquamiceps caeruleus new species
Figure 1

Material Examined.—Holotype, ISH 513/75, 14°11'N, 18°28'W, 0–2,000 m, 18 July 1974, ANTON DOHRN st. 11/74, 280 mm SL, female immature; Paratypes, ISH 1652/71, 21°35'S 02°00'W, 0–2,100 m, 3 April 1971, WALTHER HERWIG st. 443/71, 3 specimens (139, 290, 291 mm SL); ISH 2059/71, 05°30'S, 16°28'W, 0–1,900 m, 9 April 1971, WALTHER HERWIG st. 467/71, 337 mm SL; ISH 2659/71, 14°05'N, 23°12'W, 0–1,900 m, 16 April 1971, WALTHER HERWIG st. 494/71, 256 mm SL; ISH 2864/71, 20°27'N, 21°58'W, 0–2,100 m, 18 April 1971, WALTHER HERWIG st. 502/71, 292 mm SL; USNM 214938, 26°24'N, 90°45'W, 0–2,740 m, 24 July 1959, OREGON st. 2566, 315 mm SL. Other material, ISH 2481/71, 07°32'N, 20°54'W, 0–1,300 m, 14 April 1971, WALTHER HERWIG st. 486/71, 107 mm SL.

Diagnosis.—In key above.

Description.—The overall shape of *A. caeruleus* is shown in Figure 1. When fresh (Bullis, personal communication), the skin covering the head (including the maxillary and presumably the premaxillary), opercle, posttemporals, branchiostegals, and broadly joined branchiostegal membranes was a deep cobalt blue (Fig. 1). The skin on the unscaled bases of the pectorals, pelvics, dorsal, anal and caudal was a lighter blue. The body was black. After fifteen years in preservative the blue color of USNM 214938 has faded only slightly. The scales between the posttemporals and along the dorsal and ventral midline are dark blue-black,

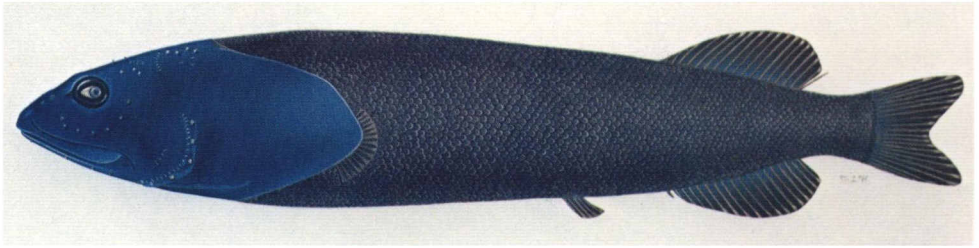


Figure 1. *Asquamiceps caeruleus* n.sp., paratype, USNM 214938, 315 mm SL, part of snout and caudal fin reconstructed on the basis of holotype. Colors based on Kodachrome slides of fresh specimen, courtesy of H. Bullis. Painting by Mike Williams.

becoming mottled light brown along the side where the exposed edges of the scales now appear unpigmented.

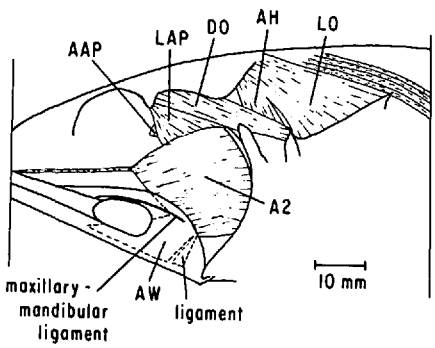
The oblong cycloid scales have a very slight median ridge and are irregularly arranged along the sides. The middorsal and midventral scales are smaller and crowded; they form a ridge for a short distance anteriad of the dorsal and pelvics, respectively. The scalation between the posttemporals is V-shaped, the apex directed anteriad. From the cleft of the opercle, approximately at the cleithrum-supracleithrum joint, to the origin of the dorsal, there are 40–50 irregular transverse scale rows. There are no scales on the supracleithrum, cleithrum or isthmus, all of which are covered by light blue skin.

There are 9 or 10 raised preopercular-mandibular pores, the preopercular series preceded by about 20 relatively long (up to 2.7 mm) papillae which in turn are preceded by a group of 4 or 5 papillae posteriad of the upper jaw. There are 6 or 7 infraorbital, at least 5 supraorbital, 2 or 3 posttemporal, and 2 or 3 postorbital pores. A compact group of three to five papillae are located behind the posteriormost supraorbital pore. There are 8 long papillae medial to each supraorbital series, 3 papillae between the supraorbital and postorbital series, 3 long papillae and several small ones behind the dilatator spine on the operculum, and 12 papillae comprising a broadly interrupted supratemporal series. There are numerous very minute white papillae covering the broad, slightly concave, interorbital area.

Morphometry of the type series, 139–337 mm SL, are expressed below as a percent of SL, those of the holotype in parentheses: head length 36.8–45.3 (40.4), snout length 7.4–10.0 (7.8), snout to pectoral fin base 33.2–34.6 (34.2), snout to pelvic fin base 58.2–64.8 (58.2), snout to anal fin origin 72.1–76.5 (72.1), snout to dorsal fin origin 72.1–75.2 (72.1), maximum diameter of orbit 5.3–7.7 (6.0), minimum interorbital distance 6.6–8.0 (7.5), sphenotic width of skull 11.3–14.7 (12.1), upper jaw length 12.5–16.9 (13.6), lower jaw length 15.6–20.9 (16.3), dorsal-fin base length 14.5–17.0 (16.6), anal-fin base length 13.3–15.9 (15.6), minimum depth of caudal peduncle 6.2–7.9 (7.9), and postdorsal fin length 11.8–14.5 (13.6).

Meristic data for the type series are as follows, those of the holotype in parentheses: D 16–18 (17), A 15–17 (17), left P_1 14–16 (14), right P_1 15–17 (15), P_2 5 (5), vertebrae 21–22 + 20–22 = 42–43, gill rakers on first arch 7–9 + 1 + 14–17 = 23–26 (8 + 1 + 14 = 23), branchiostegal rays 5–7 (6), pyloric caeca 9–11 (10). Males have folded or convoluted testes without lobes.

A small (ca. 107 mm SL), partly damaged specimen (ISH 2481/71) was cleared and ossified structures stained with alizarin Red S following the procedures of



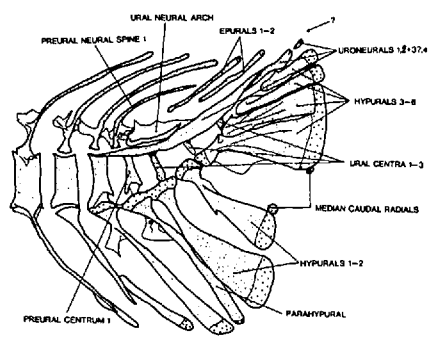


Figure 2. (Left) *Asquamiceps caeruleus* n.sp., paratype, ISH 1652/71, 291 mm SL, cheek muscles.
Figure 3. (Right) *Asquamiceps caeruleus* n.sp., ISH 2481/71, caudal skeleton, cartilage indicated by large stipple, bone indicated by small stipple.

Taylor (1967). In addition a paratype (ISH 1652/71, 291 mm SL) was available for partial dissection of its cheek muscles.

Cheek muscles.—The cheek muscle arrangement in *A. caeruleus* shows a number of primitive features relative to other alepocephaloids (unpublished observations). The adductor mandibulae (A2) shows no derived features and is very typical for the superfamily (Fig. 2). The lateral fibers of A2 act through a ligament inserted on the dorsal edge of the maxillary and the medial fibers insert through a ligament on the coronomeckelian (Fig. 2). These fibers are not separated within A2. The other jaw muscle, AW, is a thin parallel muscle which is lateral to the coronomeckelian ligament and inserts in the Meckelian fossa of the dentary. There is a ligament connecting the maxillary and dentary and a membrane connecting the posterior end of the maxillary with the lateral surface of the dentary. This membrane forms a lip which extends half the length of the dentary.

In other alepocephaloids, the adductor hyomandibulae (AH) appears to be derived from the adductor arcus palatini (AAP) (unpublished observations), but in *A. caeruleus* there appears to be an incipient subdivision of AH from the levator operculi (LO) (Fig. 2). An adductor operculi (AO), although quite often found in alepocephaloids, was not found in *A. caeruleus*. An apparently derived feature (relative to the family) of the cheek muscle arrangement in *A. caeruleus* is the restriction of the levator arcus palatini (LAP) to the area around the point of the sphenotic and the occupation of most of the sphenotic-pterotic arch by the base of the dilatator operculi (DO) (Fig. 2). The voluminous opercles in *Asquamiceps* are due to the accessory opercular bundles of muscle and connective tissue (Fig. 2).

Axial and caudal skeleton.—Most *Asquamiceps* have from 3 to 10 more caudal than precaudal vertebrae but *A. caeruleus* generally has equal numbers of each. Radiographs and the alizarin-prepared specimen (ISH 2481/71) showed 3 to 5 predorsal bones. Pleural, epipleural and epineural bones are present.

The caudal skeleton of *A. caeruleus* is, in general, the most primitive of all

alepocephaloids (Fig. 3). The illustrated specimen, a juvenile, has three ural centra, a primitive, generally considered aberrant, feature in teleosts (Nybelin, 1971; Weitzman, 1974). Radiographs of six other *A. caeruleus* showed half with two ural centra, two with three and one with four ural centra. The latter (ISH 2059/71) is 337 mm SL and had one centrum each at the base of the first and second, third, fourth, and fifth hypurals. In the illustrated specimen (Fig. 3), the upper and lower ural centra are completely ossified rings while the middle one is ossified on the right side and mostly unossified on the left side. Between ural centra 1 and 2 on the right side is another small ossification completely hidden by the first uroneural. Since it is not possible to discern which centrum belongs to the single ural neural arch or if the arch is actually compound, it cannot be shown that these are either complete vertebrae or a pair of hemicentra (Greenwood, 1970). The uppermost centrum appears to be homologous with the second ural centrum of other alepocephaloids. The middle one, in spite of the fact that it appears to give partial support to the third hypural, apparently fused with the lower centrum in all other alepocephaloids to form a compound first ural centrum. Nybelin (1971 and 1973) has suspected a compound origin for the first ural centrum in the fossil leptolepids and *Elops*.

There are four uroneurals on the right side, three on the left and a fifth unpaired ossification (?) distally (Fig. 3). There are two epurals. There is no laminar bone on the strap-like first uroneural. The first ural neural arch is autogenous and has extensive development of laminar bone, which has developed uniquely in a longitudinal axis and crosses the top of the lowermost ural centra. It is not fused to the first uroneural. Laminar bone is present on the first four neural and first haemal preural spines and the parahypural. An accessory bone located next to the second haemal spine (unlabeled in Fig. 3), is cylindrical, blunt at each end, cartilagenous distally and free from its associated haemal spine. It was also found in a third of the X-rayed specimens.

The first and second hypurals are separate (Fig. 3), unlike other alepocephaloids in which there is distal fusion of the cartilage (this difference may be due to the small size of the specimen). The distal edge of the lower hypurals is distinctly ahead of the distal edges of the upper hypurals and the first hypural is only slightly deeper than the second. Part of the internal caudal symmetry that was acquired in early teleosts was the nearly vertical alignment of the edges of the upper and lower hypurals (Patterson, 1968). In alepocephaloids this has been achieved through lengthening and the distal vertical expansion of the first hypural. Thus, the lower hypurals in *A. caeruleus* represent a primitive condition for alepocephaloids.

Two median caudal radials each support a fin ray. The dorsal procurrent, upper principal, lower principal and ventral procurrent fin rays number respectively: 9, 10 + 9, 8.

Pectoral and pelvic girdles.—The pectoral girdle was incompletely ossified. However, the following features were noted: a mesocoracoid was absent, the scapula and coracoid were unossified, postcleithra were absent, the coracoid had a long cartilaginous ventral process, there were four ossified proximal radials, two smaller cartilaginous proximal radials above the uppermost ossified radial, and fin rays were supported by distal cartilaginous radials which were supported only by ossified proximal radials.

The pelvic girdle has a small pubic plate, no iliac process, a medially expanded ischial cartilage in contact with its opposite member, a small posterior ischial process, five fin rays and no split bone.

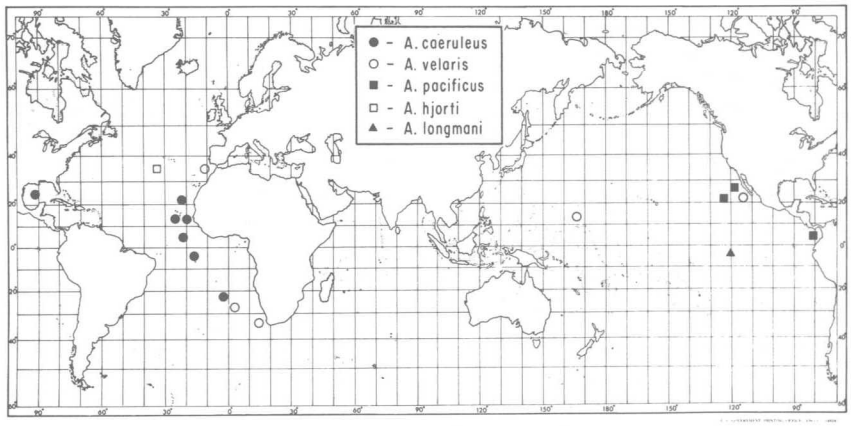


Figure 4. Chart of World Ocean showing distribution of examined material of *Asquamiceps*.

Asquamiceps longmani Fowler 1934

Asquamiceps (Megalepocephalus) longmani Fowler 1934: 248.

Material Examined.—Holotype: USNM 92325, 3°34′10″S, 120°50′30″E, about 1,100 m, 18 December 1909, ALBATROSS station 5655, 183 mm SL.

Comments.—I found no indication of scales on cheeks, postocular, cranium or opercles (Fowler, 1934). Additional errors in Fowler's description were found in fin-ray and branchiostegal-ray counts and in the reported size of the holotype (183 mm SL not 123 mm).

Additional specimens of *A. longmani* and *A. hjorti* are needed in order to clarify their distinctiveness. The above key includes all salient differences found in the two holotypes.

Meristics of the holotype were as follows: D 19, A 19, P_1 18, P_2 6, branchiostegal rays 5, gill rakers on first arch 6 + 1 + 14 (Fowler, 1934) vertebrae 17 + 27 = 44, pyloric caeca 6(+?) (Parr, 1954). The holotpe is a male with lobate testes.

Asquamiceps hjorti Koefoed 1927

Asquamiceps hjorti Koefoed 1927:43.

Material Examined.—Holotype: UBNM 3335, 34°59′N, 33°1′W, 2,600 m wire out, 8–9 June, 1910, MICHAEL SARS station 53, 195 mm SL.

Comments.—Without additional material little can be added to Koefoed's original description. Meristics of the holotype were as follows: D 20, A 19, left P_1 18, right P_1 19, P_2 6, branchiostegal rays 6, gill rakers on first arch 8 + 1 + 17, vertebrae 18 + 24 = 42, pyloric caeca 10. The holotype is a male with poorly defined lobate testes.

DISCUSSION

Distribution.—*Asquamiceps* is circumtropical (40°N–40°S) and bathypelagic (most captures from nets trawled below 2,000 m). The examined material came from the Atlantic and Pacific Oceans (Fig. 4), but Sazanov (personal communication) has identified both *A. caeruleus* and *A. longmani* from recent Soviet cruises to the Indian Ocean.

Interrelationships.—In an unpublished dissertation (Markle, 1976), I have discussed the polarity of a number of alepocephalid characters. Two of these were the tendencies among the genera, *Asquamiceps, Einara, Conocara, Leptoderma* and *Aulostomomorpha,* to increase the number of caudal relative to precaudal vertebrae and to decrease the relative size of scales. Both character phylogenies reach the most derived state in the naked, eel-like genus *Leptoderma*. Additional reductional character sequences within this group of genera are the reduction in number of epibranchial gill rakers and pyloric caeca which also reach the most derived state in *Leptoderma* (0 and 2, respectively).

Within *Asquamiceps* there appear to be character phylogenies which parallel these intergeneric tendencies. The relative number of precaudal and caudal vertebrae is quite variable in *Asquamiceps* and ranges from approximate equality in *A. caeruleus,* the presumed primitive state, to 10 more caudal than precaudal vertebrae in *A. longmani*. All *Asquamiceps,* except *A. velaris,* have 42–44 total vertebrae so that the character state in *A. longmani* can be simply viewed as a forward shift of five vertebrae by the first haemal arch. The situation differs in *A. velaris* which has five less total vertebrae than any other *Asquamiceps* and the lowest number of vertebrae in the family. It has three to five more caudal than precaudal vertebrae. The relative number of precaudal and caudal vertebrae can change due to addition or loss of one or the other types of vertebrae and/or the relative shift of the first haemal arch. Therefore, although the polarity of the character may be known, the same derived state may be reached through more than one sequence.

The body scales in most *Asquamiceps* are relatively small and imbricate as in *A. caeruleus* (Fig. 1). The single exception is *A. velaris* which has barely or non-imbricate scales and a naked predorsal midline. The reduction in number of epibranchial gill rakers is also most pronounced in *A. velaris* which has four to five while the rest of the genus has seven to nine. In addition, *A. velaris* has only three to four pyloric caeca compared to eight to eleven in the other species. Although it is premature to speculate on the interrelationships of *Asquamiceps,* the present review at least suggests that *A. velaris* is not a primitive or typical member of the genus.

No matter what the position might be of *A. caeruleus* within the genus, its anatomy suggests a relatively primitive grade within the family. The cheek muscles show few of the specializations found in other genera. For example, there are no subdivisions or multiple maxillary insertions of A2; AH is not a completely separate muscle; and AO is not formed (Fig. 2). The caudal skeleton is the most primitive known in the family (see Greenwood and Rosen, 1971). The primitive features include two to four ural centra, four uroneurals, no laminar bone on the first uroneural, first uroneural reaching to second preural centrum, laminar bone on neural and haemal spines, separate first and second hypurals, distal edge of lower hypurals ahead of distal edge of upper hypurals, presence of median caudal radials and 19 principal caudal radials (Greenwood and Rosen, 1971; Rosen, 1974; and Markle, 1976). In the pectoral girdle the remnants of six proximal radials may also be primitive.

A few derived characters can also be identified in *A. caeruleus*; restriction of LAP to the point around the sphenotic, occupation of most of the sphenotic-pterotic arch by the DO, accessory bundles of muscle and connective tissue behind the opercle, two epurals, no mesocoracoid, and no pelvic splint bone. Half of these are reductional characters.

Little can be said at present about the interrelationshps of *Asquamiceps*. Additional material is needed to clarify the validity of some species (*A. longmani*

and *A. hjorti*), as well as the relationships of *A. velaris*. Suspected relationships of the genus have been alluded to above. However, the only conclusion that can be made on the basis of the present material is that many character states in *Asquamiceps* represent a primitive alepocephalid grade.

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